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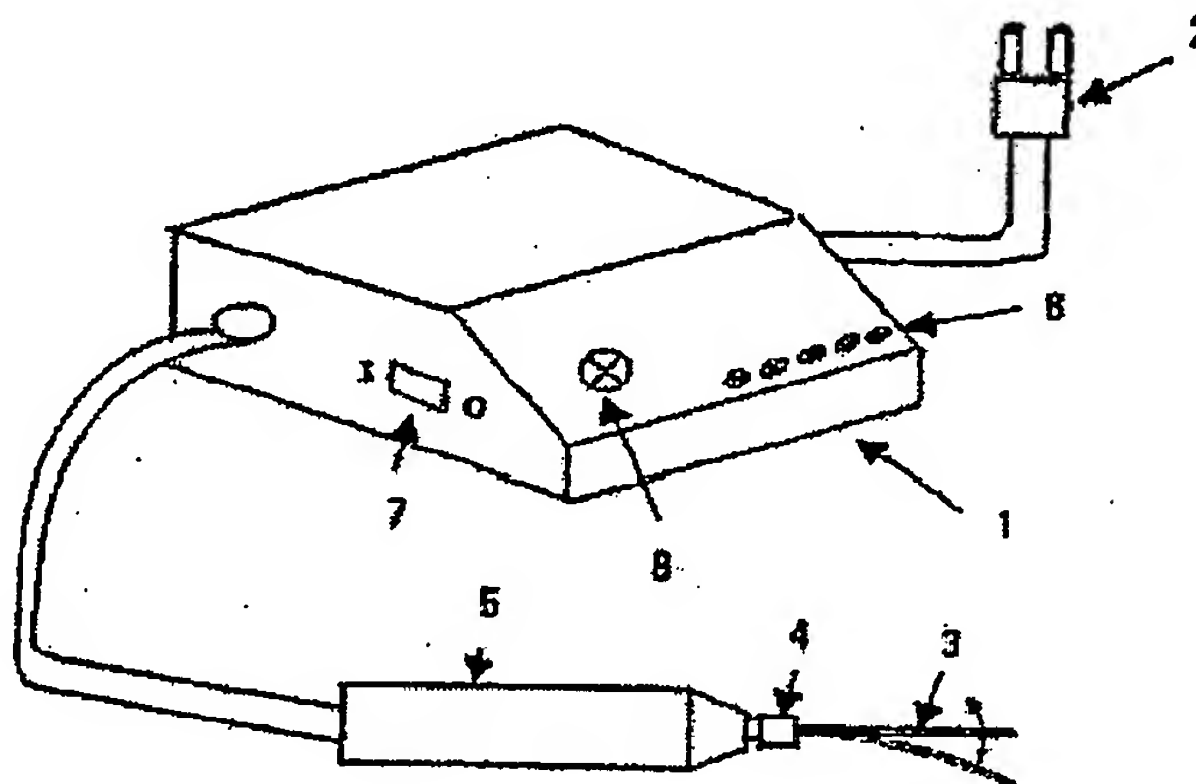
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(54) Title: ENDODONTIC APPARATUS AND METHOD FOR FILLING OF PREPARED ROOT CANALS



(57) Abstract: Technique of filling of any root channel of the teeth, performed with the combined use: of an apparatus able to make reach, in checked way, to a tip in copper (3) with conductivity and a flexibility that it allows him to suit for the curved root channel of the tooth reaching under all the conditions the 2 mm from the apex, the temperature of softening of a material of filling gutta-percha, and of a tip in Nickel-titanium (9) to high flexibility as plugger or adapter to cold of the gutta-percha since to the apex of the root channel. The technique results simple and sure and allows the clinician to get the hermetic closing of the root channel to the desired length and above all awareness of what he is doing and in what channel he is operating, so that to always get and constantly the same result.

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Description

"Endodontic apparatus and method for filling of prepared root canals".

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Relative technical field

This invention can be classified in the field of endodontic instruments used in the treatment of root channels; in particular this invention is composed of an apparatus with a highly flexible heating probe and an associated method for the application of a type of filling material for  
10 preventively prepared root channels.

Actual techniques in use today

As is well-known, a rubbery, natural material called gutta-percha,  
15 obtained from certain types of trees and then adequately purified, is used to fill root channels. Recently a mixture of this material together with other elements such as zinc oxide is being used as this gives better characteristics for this use.

The most common method of filling dental cavities with gutta-percha is  
20 to insert small quantities of heated gutta-percha into the cavity with a heated probe and compact the material in the cavity using a plugger. This procedure takes the dentist a long time and in the best of hypotheses it is tedious and in some cases the cavity is not perfectly filled and sealed.

Therefore the traditional techniques used for filling dental cavities do not  
25 insure that the root channel has been completely and accurately filled with the filling material.

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Experience has shown that inaccurate filling of root channels is the major cause of failure of endodontic therapy.

Various problems and inconveniences are associated with the traditional techniques of vertical compacting of the filling material in a root channel, one of these, for example, is the risk that the final length of the plugger or the gutta-percha might be pushed beyond the end of the channel, or, and this can happen quite easily, the gutta-percha flows from the top towards the bottom (downwards) against the end of the channel rather than laterally, in such a way that perfect lateral filling of the channel cannot be carried out satisfactorily. It is also possible that the gutta-percha flows upwards between the plugger and the wall of the channel and pours out of the upper opening of the channel rather than flowing towards the end and laterally to fill the channel.

Many instruments are in use together with their relative methods for filling root channels. The instrument that is most similar to this invention is a recent patent from the 13<sup>th</sup> of April 1999, N° US 5.893.713, composed of a heating apparatus with a tip in Nickel-Titanium of a rather complicated design made to be inserted into the root channel after it has been partially filled with gutta-percha, and which is forced to penetrate into the filling material itself that is compacted and therefore pushed into the lateral channels. The tip is extracted by carrying out a twisting rotation in such a way that the filling material does not adhere to the tip itself.

It is well-known that Nickel-Titanium tips are highly flexible and more resistant to breakage compared to those in steel, but in the smaller sizes, the flexibility of the instrument reduces the possibility of carrying out a

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satisfactory filling, also because the extremity of the instrument tends to deflect backwards in some curved channels. In fact, the patent foresees a heating Ni-Ti tip capable of penetrating into the filling material and which also acts as a plugger. In order to do this it would have to have an adequate diameter, therefore the instrument must, of necessity, stop 5mm before the end of the channel, thus diminishing the certainty of an efficient filling.

Aims and advantages of this invention

10 The principal objective of this invention is to provide an apparatus and a method for filling root channels with the aim of filling root channels faster and more efficiently in order to reduce both the time necessary to complete the technical application and to reduce the risk of incomplete filling of the root channel.

15 The technique described in the patent which refers to this invention represents a notable improvement of the aforementioned patent, overcoming all its inconveniences and limits.

This invention is composed of a kit of instruments for filling root channels and a new method that uses these instruments for a filling procedure that eliminates the problems described above.

20 In particular the invention provides a technique for heating the gutta-percha inserted beyond the curve of the root channel, using a probe with an extremely flexible copper tip which is able to penetrate into the gutta-percha, to heat it and to modify its physical state along the final length of the channel, thus allowing the gutta-percha, which has now become  
25 softened, to be adapted to the shape of the end of the channel using a

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further tool with a tip in Nickel-Titanium which has the same characteristics of flexibility as the heated probe, to form a plug that will completely and hermetically isolate the inner part of tooth from the outer part.

5

A description of the drawings

Further characteristics and advantages of this invention are shown in detail in the attached drawings, in one of the ways in which this invention can be carried out. These illustrations are indicative and not

10 limiting:

Figure 1 is a schematic drawing of the heating apparatus and the copper tipped probe that forms a part of this invention.

15 

Figure 2 is a sketch of the Nickel-Titanium tip that is a further part of this invention.

Figure three is a schematic drawing of the tip of the heating instrument inserted in the filling material (gutta-percha) contained in the curve of a root channel.

20 

In reference to figure 1, (1) indicates the body of the container that contains the electronic and electric apparatus, (2) indicates the plug that connects the instrument to the power grid at 220V, (3) indicates the copper tip, the body of which is cylindrical, smooth and tapered towards the adequately rounded tip. (4) indicates the electric resistance of the instrument that transforms the applied voltage into heat, thus heating the tip (3), (5) indicates the handle, (6) indicates the light emitting diodes

25 

that signal the temperature level reached by the tip (3), (7) indicates the

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on/off switch that is signalled by the light (8), (9) indicates a highly flexible Nickel-Titanium tip to be used cold for compacting or adapting the gutta-percha at the end of the root channel.

The tip (3) has been realised in such a way as to sustain the temperature  
5 necessary to soften the filling material so that it will fill the root cavities efficiently and easily.

The tip (3) is made of an annealed, non-alloy copper, which, thanks to its high level of conductivity allows the immediate transformation of the applied voltage into heat, thus consenting this tip to be easily handled  
10 thanks to the characteristics of flexibility of the metal, which, when introduced into a root channel, follows its curved route, whatever form this takes, in such a way as to facilitate access to the ends of the root channels, which would otherwise be inaccessible.

15

Methods for carrying out this invention

After the crown of the tooth has been opened, a series of delicate, flexible instruments of ever increasing diameter are used to clean and to free the channel from the pulp as practically as possible and to shape the  
20 root channel (10).

Once the channel has been prepared a series of operations, essentially measurements, are carried out:

- a) the length of the root channel is measured (10);
- b) the cone of gutta-percha is chosen in such a way that it can be  
25 positioned at a distance of 2mm from the end of the root channel (11);



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c) the previously heated heat carrying tip (3) is positioned at a distance of 2mm from the end of the root channel;

d) the cold tip (9) of the Nickel-Titanium apparatus is positioned at a distance of 1mm from the end of the root channel.

5 When the rubber stoppers have been positioned at these measurements, the therapy can be begun:

using the heated tip (3), the upper part of the cone of gutta-percha is taken away, the heated tip (3) is then inserted for 2-3 mm into the cone of gutta-percha (12), the heated tip (3) is then removed and, using

10 ordinary pluggers, the operation of compacting the gutta-percha is begun, the plugger is then removed and, in the space left by the plugger, the heated tip (3) is inserted for a further 2-3mm, continuing in this way until a distance of 2mm from the end of the root channel is reached. At this point it is certain that all the gutta-percha has been heated and can  
15 therefore be modelled and the heated tip can be withdrawn without dragging the gutta-percha behind it. At this point the cold tip (9) can be pushed into the empty space left by the heated tip as deep as 1mm from the end of the root channel. This manoeuvre will push the gutta-percha down consistently for 1mm and therefore it is certain that the filling  
20 material has reached the desired depth; in fact, the vertical and lateral impulse given by the cold tip (9) to the gutta-percha will permit this to advance for 1mm, and only 1mm, and to adapt its shape to that of the end of the root channel, thus closing off any eventual lateral channels (13).

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If the aforesaid measurements are respected, a hermetic seal at a distance of 1mm from the end of the root channel will consistently and repeatedly be obtained.

In the same way it is also possible to obtain, in any case, the hermetic  
5 scaling of the root channel at the desired depth. In fact, the hermetic seal can be created at the end of the root channel or at 1mm from the end, as desired.

The great innovative advantage of this invention as proposed in this description, consists in:

- 10 a) proposing a tip in annealed non-alloy copper (3) to heat the gutta-percha in the root channel,
- b) the method for a combined use of the copper tip (3), which is an optimum heat conductor and therefore capable of heating the gutta-percha in a shorter time and at a lower temperature (the working  
15 temperature of the copper tip ranges from 105° to 130°C.) compared to the inventions using the preceding technique, also its notable flexibility allows it to adapt itself to the curved root channel of the tooth, in all conditions reaching a distance of 2mm from the end of the channel, and of the Nickel-Titanium tip (9) which forms a highly flexible plugger or  
20 instrument used to adapt the shape of the gutta-percha to the end of the root channel without further use of heat.

From what has been described and illustrated above, it can be seen that this invention fulfils the aims described as it proposed to do.

All the details may be substituted by other equivalent elements, in  
25 practise the materials, the dimensions and the shapes of the container (1)



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can be varied, as can the electronic cards and signalling elements contained in it as well as the size and shape of the handle (5).

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Claims

- 1) An apparatus composed of:  
a container (1) with electronic and electric control and command circuits  
connected to the power grid, a handle (5), associated to an electric  
5 resistance (4), characterised by the fact that this apparatus, in a  
controlled way, heats a highly flexible copper tip which has a high level  
of conductivity to reach the necessary temperature (ranging from 105° to  
130°C) in order to make the filling material, usually gutta-percha,  
contained in any root channel soft and adaptable up to a distance of 2mm  
10 from the end of the root channel.
- 2) An apparatus as described in claim 1, in which the annealed, non-  
alloy copper tip (3) has a cylindrical, smooth body that is tapered along  
its longitudinal axis, right up to the tip, which is adequately rounded.
- 3) A filling technique for any tooth root channel characterised by the  
15 fact that it is carried out with the combined use of:  
an apparatus capable of heating an annealed, non-alloy copper tip (3) in a  
controlled way and which is flexible enough to ensure that it can adapt  
itself to the curve of the root channel of the tooth and reaching, whatever  
shape the curve of the channel may be, a distance of 2mm from the end  
20 of the root channel, at a temperature necessary to soften a filling  
material, usually gutta-percha, inserted in the root channel.  
an apparatus with a highly flexible Nickel-Titanium tip (9) for use as a  
plugger or an instrument which is capable of adapting the gutta-percha  
right up to the end of the root channel without further use of heat.
- 25 4) A filling technique for any type of tooth root channel, as described in  
claim 3), characterised by the fact that, once the root channel has been

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prepared a series of operations, essentially measurements, are carried out:

- a) the depth of the root channel is measured;
  - b) the cone of gutta-percha is chosen so that it can be positioned at 2mm
  - 5 from the end of the root channel;
  - c) the heat-carrying tip (3) is positioned at a distance of 2mm from the end of the root channel;
  - d) the cold tip (9) of the Nickel-Titanium apparatus is positioned at a distance of 1mm from the end of the root channel
  - 10 e) once the usual rubber stoppers are positioned at these measurements, the therapy can be begun.
- 5) A technique for filling any type of tooth root channel, as described in claims 3) and 4), characterised by the fact that:
- once, using the heated tip (3) the upper part of the cone of gutta-percha is
- 15 removed,
- the heated tip (3) is inserted for 2-3mm into the cone of gutta-percha,
- the heated tip (3) is removed, and the operation of compacting the gutta-percha, using ordinary pluggers, is begun,
- the plugger is removed and, in the space left by it, the heated tip (3) is
- 20 inserted for a further 2-3mm, continuing in this way until a distance of 2mm from the end of the root channel is reached;

at this point, the cold tip (9) is then inserted in the space left by the heated tip, which had previously been inserted and then removed, and it will reach a distance of 1mm from the end of the root channel, while the

- 25 vertical and lateral impulse transmitted by the cold tip (9), will

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consistently push the gutta-percha for a further 1mm, thus allowing it to adapt itself to the end of the root channel and to seal any lateral channels.

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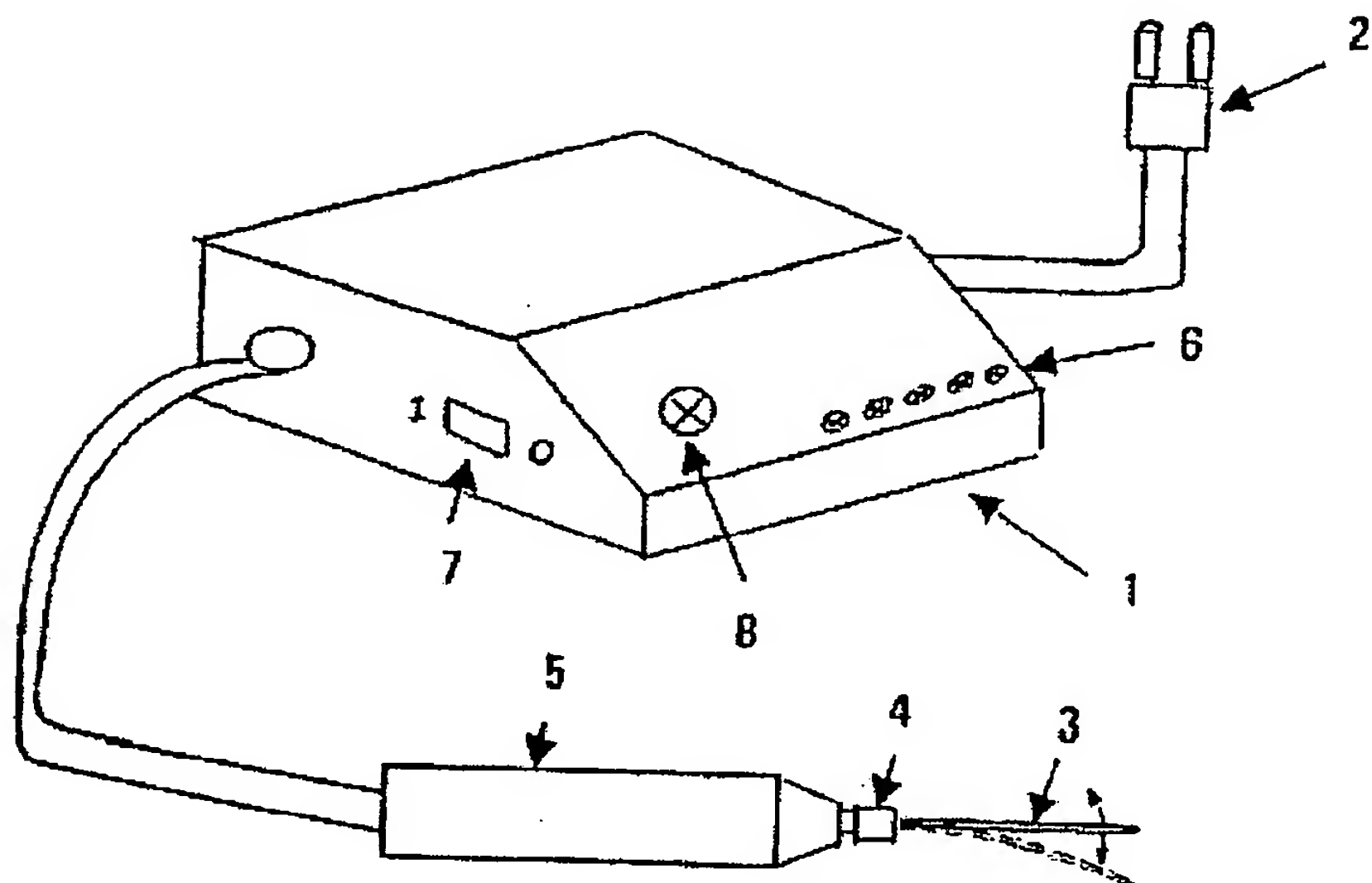


FIG. 1

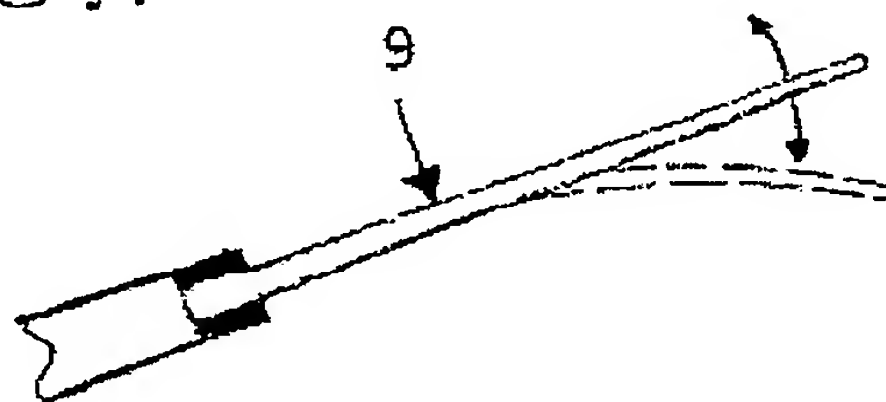


FIG. 2

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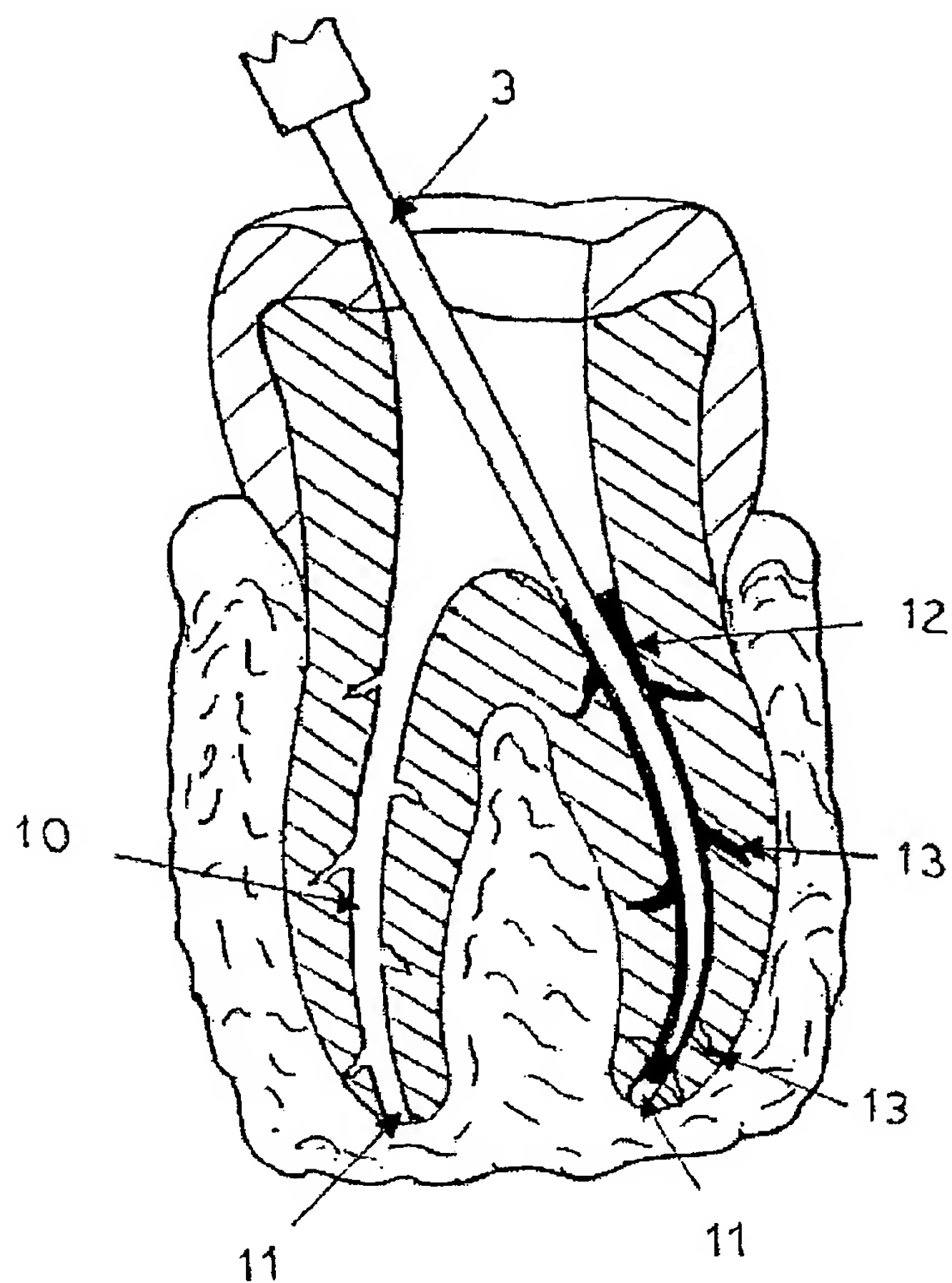


FIG. 3

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<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 7 A61C/04 According to International Patent Classification (IPC) or to both national classification and IPC														
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC 7 A61C Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data, PAJ														
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <table border="1"> <thead> <tr> <th>Category *</th> <th>Description of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>US 5 893 713 A (GARNAN GARY ET AL) 13 April 1999 (1999-04-13) cited in the application column 2, line 7 - line 23 column 5, line 16 - line 36 figures 1-4</td> <td>1-3</td> </tr> <tr> <td>A</td> <td>US 4 527 560 A (MASRELIEZ CARL J) 9 July 1985 (1985-07-09) column 1, line 56 - line 66 column 3, line 46 - line 68 figures 1-5</td> <td>1-3</td> </tr> <tr> <td>A</td> <td>WO 82 03763 A (SOLAR ENERGY TECHN INC) 11 November 1982 (1982-11-11) page 8, line 1 - page 9, line 16; figures 1-4</td> <td>1-3</td> </tr> </tbody> </table>			Category *	Description of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	A	US 5 893 713 A (GARNAN GARY ET AL) 13 April 1999 (1999-04-13) cited in the application column 2, line 7 - line 23 column 5, line 16 - line 36 figures 1-4	1-3	A	US 4 527 560 A (MASRELIEZ CARL J) 9 July 1985 (1985-07-09) column 1, line 56 - line 66 column 3, line 46 - line 68 figures 1-5	1-3	A	WO 82 03763 A (SOLAR ENERGY TECHN INC) 11 November 1982 (1982-11-11) page 8, line 1 - page 9, line 16; figures 1-4	1-3
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Date of the actual completion of the international search 25 August 2000		Date of mailing of the international search report 04/09/2000												
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## INTERNATIONAL SEARCH REPORT

Information on patent family members

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